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The Effect of College Major on Wages

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Abstract
Long before the time their children enter the doors on their first day of kindergarten, most parents are already dreaming of and perhaps fearing the time thirteen years down the road when they will be sending their young scholars off to college. Many of these hopeful parents assume that a chance for higher education will allow their child the opportunity to have a prosperous and secure future. And, numerous studies have shown that the prayers of lots of these parents will be answered, as college graduates consistently earn higher wages than their less educated counterparts (Belfield, 2000).

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I. INTRODUCTION

Long before the time their children enter the doors on their first day of kindergarten, most parents are already dreaming of and perhaps fearing the time thirteen years down the road when they will be sending their young scholars off to college. Many of these hopeful parents assume that a chance for higher education will allow their child the opportunity to have a prosperous and secure future. And, numerous studies have shown that the prayers of lots of these parents will be answered, as college graduates consistently earn higher wages than their less educated counterparts (Belfield, 2000).

In 2001, there were nearly 16 million people enrolled in some form of higher education in the United States surely most of whom faced hard work and sacrifice in exchange for this dream of a successful future (US Census Bureau, Current Population Reports, 2003). Even before they entered their first lecture hall, these students likely spent countless hours looking through college brochures, studying for their SATs, writing entrance essays, and filling out financial aid forms all for a chance to go to the college or university of their choice. But as they step onto campus for the first time their freshmen year, it is a different choice that these students must glaringly confront as they introduce themselves to roommates, faculty, and other students. Because undoubtedly each fall, "What's your major?" are the daunting words facing many uncertain undergraduates. For these undecided students, the process of choosing a field of study that will affect their next four years and likely their entire adult careers may seem overwhelming. And even for those students who enter the academic gates with a chosen major, most will question their choice and many will subsequently switch fields.

"College graduates consistently earn higher wages than their less educated counterparts."

But if so many studies have shown the positive rate of return associated with simply going to college, is this decision really such an important one? The answer is of course "yes" because common sense suggests that there are many things that must be considered in choosing a college major including interests, skills, desired lifestyle, and future earnings. Yet despite this broad array of factors to consider, recently a survey found that, "Being very well off financially" was a very important or essential personal objective of 73.6% of college freshmen suggesting that for many students a top-priority is in fact earnings (US Census Bureau, Statistical Abstract of the United States, 2001). If financial success is such a critical objective of young Americans and their parents, then it seems probable that this important choice might often come down to dollars and cents.

Both salary surveys and economic research have shown at least partially that when it comes to earnings not all college majors are created equal. In 2004, the National Association of Colleges and Employers (NACE) released a list of the starting salaries of recent college graduates reporting that computer engineering majors were making on average $53,117 a year, over twice as much as the lowest ranking major on the list: psychology (Sahadi, 2004). In addition, empirical research has found that even after controlling for some aspects of human capital, economics majors earned over 27% more than those majoring in fine arts (Black, Sander, and Taylor, 2003). In a 1999 Herald Focus article, three Northwestern University professors even argue that student major has a much larger impact on income

than their choice of college or university (Convey and Kingsbury, 1999).

Yet, economic research on the impact of particular college majors on earnings remains very limited. Much of the research is focused on the role of college major in the gender wage gap. Though this research provides important insight on the gender mix across majors, it offers little theoretical background on why college major effects earnings. Most other research in the field examines the wage differentials between broad groups of majors such as business and liberal arts, which is of little help to those choosing between specific majors. Therefore, the purpose of this study is to provide a theoretical basis for the effect of college major on earnings. Furthermore, I will compare the earnings differentials among more specific groupings of majors in order to both empirically test my theory and present an economically controlled comparison of different majors.

Section II of this paper outlines my theoretical framework, which is based on human capital theory and presents my hypothesis. Section III discusses my data set and issues related to data availability. Section IV presents the empirical model used to test my hypothesis as specified for the Survey of Recent College Graduates data set and discusses my OLS regression. Finally, Section V and VI discuss the results of this study and its policy implications.

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II. THEORETICAL FRAMEWORK

From an economic standpoint, it would be pointless to attend college unless a student achieved some sort of benefit by doing so. This benefit might be in the form of increased earnings, more certain employment, some sort of non-monetary return, or any combination of these, but it must be great enough to offset the cost of attendance. In practice, individuals upon graduation typically obtain an earnings premium over those with less education in exchange for foregoing wages and incurring tuition and other college-related expenses in the present (Belfield, 2000).

Gary Becker (1993) argues students receive this wage premium because education and other forms of training are important investments in human capital. Human capital theory relies on the assumption that workers are compensated based on their productivity on the job. In equilibrium, profit maximizing firms will pay wages equal to the productivity of each individual worker, because when this occurs the benefits the firm receives from the work of each individual are equal to the expenditures it must pay for his or her wages (Becker, 1993). And according to Becker and other proponents of the human capital approach, productivity is not a stagnant concept. Taubman and Wales (1974) describe the determinants of productivity as follows:

$MP_j = g(A_j, ED_j, P_j, X_j)$

A= Innate mental ability

ED= Formal education

P= Personal characteristics such as motivation

X= All other determinants of skill

Here, they show that productivity of the *j*th person is partially affected by the education that a person receives and thus may increase over time (Taubman and Wales, 1974). This is logical since education can increase an individual's knowledge of a particular subject matter, teach technical skills, and improve important personal traits such as punctuality and perseverance all of which may make the individual a more efficient and effective worker. So individuals with more education should be more productive and consequently earn higher wages thus explaining the wage gap between college graduates and their less educated counterparts, but this paper is concerned with the wage gap that has been repeatedly shown to exist between college majors.

Like choice of additional education, I will argue the choice of field of study has an impact on an individual's human capital. The skills, knowledge, and understanding gained from one major may be entirely different from those obtained through another major. Certain majors such as computer programming and electrical engineering provide very specific, technical skills and knowledge applicable to a narrow range of job opportunities. Other majors such as English provide more broad-spectrum skills such as

written and verbal communication skills and reading comprehension that are applicable to a wider range of job positions. To explain how these differences actually affect earnings, an additional theoretical framework must be developed.

As well as formal education, Becker (1993) describes on-the-job training as a form of human capital investment. In his arguments, he presents definitions of two different types of training that can occur: *general training* and *specific training* (Becker, 1993). *General training* is useful to many firms and is therefore applicable to a wide range of jobs (Becker, 1993). *Specific training* in contrast is valuable to one or only a few firms and therefore is not as applicable to all job openings (Becker, 1993). In applying this to college major, certain majors are applicable to a more narrow range of occupations or job opportunities rather than merely a small number of firms, as Becker's (1993) on-the-job training theory describes. Defined this way, fields of study that provide very technical skill sets can be seen as providing *specific training* whereas majors such as English which provide a broader range of skills can be seen as offering *general training*. Other authors add yet another category by including *transferable training*, which is less focused than *specific training* and thus falls somewhere in between the two previous definitions (Belfied, 2000). This definition can be applied to the group of majors such as business administration that provide some very specific skills but are still somewhat broadly focused.

But what do these differing types of skill sets mean to the returns to college major? First, there must be a base amount of marginal productivity that is gained merely by completing a college degree. All students certainly improve at a minimum some traits such as interpersonal skills, perseverance, and dedication that will help them on virtually any job. Any productivity differences that exist above this base are then attributable to specific college majors.

The true human capital impact of different types of training provided by college major is best illustrated with an example. Take for instance two college graduates identical in every way except college major. Student A majors in chemical engineering and Student B majors in English. Both are given identical jobs at a large chemical manufacturer developing a new petroleum additive. Our chemical engineering major of course has knowledge of chemical compositions, lab techniques, and a variety of other skills particularly applicable to this type of job. Our English major on the other hand lacks most or all of the skills necessary to go about developing the new additive. A huge disparity in the skill level exists in this situation due to college major and thus a large productivity and, consequently, wage gap will occur between the two individuals. If instead of doing research at the chemical manufacturer, we take our same two college graduates and give them jobs at a local newspaper office; a different outcome will occur. The English major has completed courses in composition in college and therefore should be an effective journalist for the newspaper. The chemical engineering major also has basic college-level writing skills, however, and should still be able to put together an article even if it is not as eloquently composed as that of the English major. A productivity gap once again exists but this productivity gap should be much smaller than the one discussed previously. Consequently, the gap in wages should be much lower.

In applying this general framework to the market for college graduates as a whole, the following should be true. The wages for individuals majoring in fields of study that provide specific training should exceed those majoring in more general areas. If we therefore examine the programs of study of individual majors and compare them in terms of specific skills, it should be clear which fields of study students should enter to receive the highest earnings.

In the short-run, the theory that more specialized majors create more productivity and lead to higher wages seems logical and perhaps even mundane. If students are so concerned with wages as the previously mentioned statistics illustrate, why don't all students enter into highly specialized fields of study? In the long-run in a market with perfect labor mobility, this may in fact occur. More students would major in chemical engineering due to the higher wages, increasing the supply of chemical engineering majors in the market and pushing the wage for chemical engineers down. Meanwhile, fewer individuals would choose to major in English, decreasing the supply of English majors and driving up the wages of journalists. Salary surveys as well as economic research, however, indicate that wage gaps persistently exist between certain majors. Some might explain these continual gaps by examining the non-pecuniary rewards for certain majors. For example, one might argue that while education majors traditionally make

less than those entering the field of business, they get the satisfaction of helping children. However, due to the data on the importance of earnings, it seems that any non-monetary benefits associated with a particular major may be less vital to students than monetary income.

Returning to Becker's theory of on-the-job training helps to explain the long-run difference in the wages between certain majors without needing to consider the problem of non-pecuniary benefits. As Becker (1993) argues, *specific training* is valuable to only one or a few firms in the market. Majors that create specific skills, therefore, only produce skills applicable to a small number of firms in the marketplace. That is to say, if a chemical engineering major chooses not to work in the chemical industry or can not find work in the chemical industry, there are very few closely substitutable firms where the chemical engineering major could use those specialized skills. Majors that provide *general training,* on the other hand, should allow an individual to find employment in a wider range of firms because the skills that they possess are more transportable.

The smaller number of career options associated with degrees that produce more specific skills mean it is more difficult for an individual to move from one job to the next. The individual would either need to obtain more general training or a different type of specific training to widen their job opportunities. In essence, there is an opportunity cost associated with the forgone option to be able to move easily between jobs. This raises the total cost associated with majoring in specialized areas. Returning to the problem of long-run wage differentials, the market will never fully adjust to the point where the chemical engineer and the journalist make the same wage due to this added cost. In equilibrium, the market will adjust only to the point where the wage of the engineer less the additional opportunity cost associated with restricted job opportunities is equal to the wage of the journalist. That is:

$$\text{Wage}_{\text{specialized}} - \text{opportunities costs} = \text{Wage}_{\text{general}}$$

This same comparison can be made between the wages of individuals majoring in specialized versus transferable skill majors and individuals majoring in transferable versus general majors. The more specialized the major field of study the greater the opportunity cost and the higher the wage must be to offset the additional opportunity cost. Thus even in the long-run, a wage differential must persist between those who major in more specialized areas and those who major in more general areas.

Looking at salary surveys, this theory seems to at least initially hold true. According to the Occupational Outlook Handbook in 2002, the average starting salary for a chemical engineer with a bachelor's degree was $52,384 while the average salary for all print journalists averaged only $29,090 (US Department of Labor, 2004). This large gap can also be seen in previous years indicating a long-run wage differential. For instance according to the 1992-1993 edition of the Occupational Outlook Handbook, the average starting salary for an engineer with a bachelor's degree was $35,122 while the average starting salary for a journalist was only $22,152 (US Department of Labor, 1992).

Most economists would argue however that a variety of other human capital factors must be considered when comparing the wage gap between college majors. Every study on the matter however shows that at least some gap remains even after controlling for human capital variables when looking either at specific majors or aggregated major groups (Angle and Wissman, 1981; Black, Sanders, and Taylor, 2003; Daymont and Andrisani, 1984; Finnie and Frennette, 2003; Fuller and Schoenberger, 1991; Scholz, 1995). Since there is every indication of wage differentials and that these differentials persist across time, I formally hypothesize that, *ceteris paribus,* wage differentials exist based on college major due to the differences in training provided within the individual majors. I, henceforth, set out to categorize the majors based on training as specialized, transferable, or general and to test this hypothesis through an ordinary least squares regression model.

III. DATA

As this study is intended to both empirically test my above-mentioned hypothesis and serve as a tool for those comparing college majors, this model examines the effects of college major on earnings for undergraduates only. Additional education beyond the baccalaureate level creates further considerations beyond the scope of this study. As the majority of students complete only a bachelor's degree, this research remains applicable to most individuals.

The data set for this study is drawn from the

TABLE 1:
Empirical Model Variable Definitions

Variable	Definition
Dependent Variable	
lnWages	The natural log of hourly wages
Explanatory Variables	
Major Variables	
College Major	The individual's baccalaureate major field of study
Education and Experience Controls	
College GPA	The individual's cumulative grade point average
Work Experience	Years of full-time work experience prior to college
Work Experience2	Years of full-time work experience prior to college squared
Demographic Controls	
Gender	Male or Female
Race	The racial or ethnic group to which the subject belongs
Marital Status	The marital status of the individual as of the date surveyed
Children	Number of children the individual has.
Father's Education	Highest level of education of the individual's father
Mother's Education	Highest level of education of the individual's mother
Labor Market Controls	
Region	Region of the country where the individual worked
Government Employee	Individual works for the federal, state, or local government
Self-employed	Individual is self-employed
Non-related job	Individual reports their job is not related to their college major

Recent College Graduates Survey (RCG), 1985-1986. This survey was conducted by the National Center for Educational Statistics, a division of the United States Department of Education (US Dept. of Education, 2001). The survey explores the immediate employment of individuals graduating with bachelors and masters degrees from United State's colleges and universities. This study includes information on employment, field of study, demographic characteristics, and other variables (US Dept. of Education, 2001).

Though this study is nearly twenty-years old, it remains the largest and most complete data set accessible. The age of the data may have some impact on the wage differentials, but this impact should not be significant for the majority of fields of study as the training provided by most majors does not change significantly over time with the possible exception in areas such as computer technology. The sample size of 16,811 undergraduates far exceeds the applicable sample size of comparable longitudinal surveys including the National Longitudinal Survey of Youth (US Dept. of Education, 2001). In addition, the survey provides information on fifty specific majors, which have been coded by the original researchers (US Dept. of Education, 2001). Since data in this survey is limited to recent college graduates, research based on this data set cannot be used to measure the rate of return on college major over the lifetime of an individual as is traditionally done in the economic literature. However despite this limitation, the impact of college major on initial wage differential can be seen through the application of the empirical model, and as starting salary often has an impact on career pat,h this study remains relevant.

IV.EMPIRICAL MODEL

Ordinary least squares will be used to test the hypothesis that wage differentials exist among college majors due to differences in the types training these majors provide. The regression model is based on the model commonly used to test the rate of return on education in the human capital literature (Belfield, 2000). This empirical model is therefore stated as follows (See Table 1):

LnHourly Wages = f(College Major, College GPA, Work Experience, Work Experience2, Gender, Race, Marital Status, Children, Father's education, Mother's education, Region, Government Employee, Self-employed, Non-related Job)

As consistent with the literature, a log-linear function will be used with the log of hourly wages as the dependent variable. Hourly wages is the most appropriate measure because it eliminates problems associated with unemployment and differences in length of workweek. Individuals with no reported earnings for the year have been eliminated from this study. Though this may lead to some sample selec-

tion bias, the impact of college major on unemployment or non-involvement in the labor force is not the goal of this paper. The results of this study, therefore, are indicative only of those actively working in the labor force. A more detailed summary of all variables used in the regression as specified for the Recent College Graduates data set is presented in Appendix 1 and includes variable definitions, expected signs, and summary statistics.

A. College Major Variables

Participants in the Recent College Graduates Survey, 1985-1986 were asked to report their major field of study in college (US Depart of Education, 2001). The results of this question were then coded by the National Center for Education Statistics into 50 two-digit major field of study codes (US Depart of Education, 2001). For the purpose of this research, some of these fields were combined due to similarity in definition and small sample size (See Appendix 2). The reliance on coding by the National Center of Education Statistics for the college major variables is unfortunate because it does not allow for the examination of certain individual majors such as accounting and finance, which are both grouped into the business category. However, my grouping of majors based on this coding allows for the examination of 22 different categories of majors, which far exceeds the level of detail available in most current economic literature and preserves degrees of freedom. Though a more thorough examination of college major could be derived by examining the exact college major reported by individuals, the recoding of over 15,000 individuals is prohibitively time-consuming.

In order to test my hypothesis, I have assigned each college major variable a category of training: general, transferable, or specific. These assignments were made based on the definitions of the types of training discussed earlier and the examination of each individual major group (See Table 2). The majors were placed in each category based on personal judgment and common knowledge as no more scientific method is available for measurement. Architecture, computers, engineering, and health were assigned to the specific training group.

TABLE 2:
College Major Definitions

College Major Variable	Type of Training	N	% of Total
Communications	General	420	2.50%
Home Economics	General	153	0.91%
Letters	General	741	4.41%
Liberal Arts	General	119	0.71%
Philosophy and Religion	General	90	0.54%
Psychology	General	470	2.80%
Public Affairs	General	190	1.13%
The Arts	General	301	1.79%
Agriculture	Transferable	180	1.07%
Business	Transferable	2821	16.78%
Education	Transferable	2884	17.16%
Foreign Language	Transferable	308	1.83%
Life sciences	Transferable	441	2.62%
Mathematics	Transferable	373	2.22%
Other	Transferable	169	1.01%
Physcial Sciences	Transferable	561	3.34%
Protective Services	Transferable	129	0.77%
Social Sciences	Transferable	897	5.34%
Architecture	Specific	88	0.52%
Computers	Specific	1110	6.60%
Engineering	Specific	1042	6.20%
Health	Specific	3324	19.77%
Total		16811	100.00%

These majors have highly technical training sets applicable to only a narrow group of jobs or occupations and should therefore be expected to have the highest wages. Majors including communications, home economics, letters, liberal arts, philosophy and religion, psychology, public affairs, and the arts were included in the general training category. These major groups tend to provide a broader and shallower skill set that includes training in communications, writing skills, some analytical skills, and perhaps some research skills. As a result, these majors are hypothesized to have the lowest wages, *ceteris paribus*. All other major groups were considered to provide transferable training since they could neither be categorized as general or specific.

The college major variables are a series of dummy variables. Psychology is the omitted variable

since it is in the general training category and was found in the 2004 survey by the National Association of Colleges and Employers to have to lowest salary for the class of 2004 graduates (Sahadi, 2004). All majors in the transferable and specific training categories are expected to have positive signs since as hypothesized their wages should be greater than psychology, which is a general training major. The coefficients of specific majors should also be larger than those of transferable majors though it is not possible to determine exactly, which majors within each of the three categories of training will have the highest or lowest wages.

B. Educational and Experience Variables

If companies chose employees merely based on their college major, then the number one student in the class and the last student in the class would have the same job opportunities. In the real world, however this is simply not the case. Employers look at other factors that effect human capital. College grade point average (GPA) is always a concern for students and employers frequently use it in initial screening of employees. Higher GPA may indicate that an individual has higher inherent mental capacity or that they are more diligent workers both of which lead to higher productivity and consequently are rewarded by employers in higher wages. Fuller and Schoenberger (1991) found in their research of the gender wage gap that college GPA does in fact have a statistically significant affect on wages. Therefore, college GPA is included in this regression analysis and is assumed to have a positive impact on wages. GPA is present in the model as a series of dummy variables with a GPA of some Cs and Ds or lower as the omitted variable.

Work experience is nearly always included in calculating the rate of return to education as greater experience leads to more productivity over time (Belfield, 2000). In this research, however the data set is focused on recent college graduates. The experience of these individuals therefore is restricted to any full-time work experience they gained before entering college. The number of years of full-time experience is a continuous variable in this model. The square of work experience is also included because wages are expected to increase and then decrease over the life of an employee (Belfield, 2000).

C. Demographic Control Variables

Numerous economic studies have shown that female employees tend to earn less than their male counterparts even after controlling for other human capital factors (Daymont and Andrisani, 1984; Fuller and Schoenberger, 1991; Gerhart, 1990). Gender has therefore been included in this model with male as the omitted dummy variable.

Race and ethnicity have also been widely shown to impact wages. Racial and ethnic discrimination by employers or by other employees affects a worker's job options and his or her upward mobility within a company (Rima, 1981). This discrimination often results in wage differentials and thus a model of wages should include a race-ethnicity variable. Based on the restrictions of the data set, I have categorized race as white, black, and other; where other is defined as anyone not reporting race as white or black. The other category consists primarily of Asian and Hispanic individuals. Race is controlled for using dummy variables with white as the omitted variable to avoid perfect multicollinearity.

The 1984 study by Daymont and Andrisani indicates that an empirical model of wages should also take into account marital status and children. The effect of these two independent variables differs significantly for men and women, suggesting that an interaction between gender and each variable should be included (Daymont and Andrisani, 1984). This is reasonable since women are generally the primary caregivers of children and are more likely to leave the workforce for periods of time if married, than are men. Women with children also have higher rates of absenteeism and quit jobs more often as compared to men with children or individuals without dependents (Polacheck and Siebert, 1993). Both of these factors are very likely to lead to lower salaries. These interactions are created by multiplying the dummy variable for gender by the dummy variable for child and the dummy variable for marital status. Marital status and children are also included in the empirical model separate from the interaction terms so that it is possible to view the separate effects of these variables. The data set lacks information on the ages of children, but since most of the graduates are below the age of thirty, it can be assumed that the majority of children would still be at the age where they required some form of child care in order for their parents to work. Furthermore, information is not always available on the exact number of children, so children has

been used merely as a dummy variable that is equal to one if the individual has one or more children.

Taubman and Wales (1974) argue that in order to properly estimate the returns to education, family background must be included in the analysis. Socio-economic background can affect the choice to participate in higher education and how prepared one is to succeed once reaching college. With respect to college major, family background may also have an impact on type of major chosen. For instance, a child of an engineer may be more likely to choose to major in engineering. In addition, children of less affluent backgrounds may choose majors that they believe will lead to higher earnings since they don't have as much economic support at home to fall back on. In this study, parental education is used as a proxy for family background. Father's education and mother's education are both available in the data set and are used in the model as a series of dummy variables. The effect of parent's education on the return to college major specifically is not present in the literature so the sign in this case cannot be predicted *ex ante*.

D. Labor Market Control Variables

The area in which an individual lives and works also has an effect on his or her salary. Region of the country may play a significant role on the wages an individual is able to obtain. For instance, average wages in the southern part of the United States have historically been lower than those in the rest of the nation (Rima, 1981). Region of the country is subsequently controlled for using a series of dummy variables with the Northeast portion of the United States as the omitted region (See Appendix 3).

The industry in which an individual works also has an effect on his or her wages. Employees of the government are generally thought to receive lower wages than their private sector counterparts. Whether an individual works for any type of government be it federal, state, or local is therefore taken into account in this regression through a dummy variable. Also, individuals who are self-employed do not earn a standard salary or hourly wage the way other employees do. Earnings of self-employed individuals and private industry individuals may consequently not be comparable. As with governmental employees, a dummy variable is included in the regression to indicate self-employment.

Since this study is trying to determine the effect of college major on wages, it is important to consider whether or not an individual's post-graduate employment is related to their major. As discussed earlier if an engineering major and English major are both employed by a newspaper, the English major and not the engineering major can be expected to earn higher wages. For jobs related to their major, graduates should generally earn more than non-majors because of higher productivity. And consequently, jobs not related to an individual's major field of study should lead them to have, in general, lower wages than if they had found employment related to their major. Self-reported data for this variable is available in the data set and a dummy variable has been included in the model to capture this effect.

The issue of multicollinearity among the college major variables and all of the above mentioned control variables must be carefully evaluated. If the college major variables are in fact highly correlated with the control variables, then the coefficients of the college major variables are likely capturing some of the effect of the related control variables or vice versa. Items of particular susceptibility to multicollinearity in this study are those related to the labor market and gender. Governmental bodies may more frequently employ certain majors such as education and engineering, and female students have traditionally filled majors in both the health and education fields. Upon testing for multicollinearity in this regression through Pearson Correlations, however, no significant indications of this disease were found (See Appendix 4). The coefficients of the college major variables can therefore be viewed as capturing the *ceteris paribus* effect of choosing a particular field of study.

V. RESULTS

The restrictions placed on the Recent College Graduates Survey reduce the applicable sample size to 13,477 individuals for the initial regression (See Model A, Table 3). As previously discussed, this sample does not include individuals with zero hourly wages in the year of the study. The empirical model as a whole is significant at the .001 level and an R-squared of .243 is well within the acceptable range for a regression in labor economics.

A. College Major Variables

In order to evaluate the results and test the hypothesis that college majors that produce more technical or specialized skills lead to higher wages, it

TABLE 3
Comparison of Regression Models

			Model A			Model B			Model C		
College Major		**Type**	**Coeff.**		**t-stat**	**Coeff.**		**t-stat**	**Coeff.**		**t-stat**
+/-	Communications	General	-0.0243		-0.8490	-0.0322		-1.1480	-0.0318		-1.1340
+/-	Home Economics	General	-0.0609		-1.5180	-0.0699		-1.7670	-0.0719		-1.8200
+/-	Letters	General	0.0136		0.5260	0.0183		0.7250	0.0177		0.7010
+/-	Liberal Arts	General	0.0529		1.1570	0.0487		1.0840	0.0469		1.0450
+/-	Philosophy and Religion	General	-0.2030	**	-0.3929	-0.2092	**	-4.0940	-0.1937	**	-3.8170
+/-	Public Affairs	General	0.0500		1.3850	0.0440		1.2340	0.0426		1.1940
+/-	The Arts	General	-0.0511		-1.6040	-0.0450		-1.4450	-0.0426		-1.3710
+	Agriculture	Transfer	-0.0719	*	-1.9440	-0.0829	*	-2.2760	-0.0790	*	-2.1760
+	Business	Transfer	0.1500	**	6.9620	0.1410	**	6.6850	0.1429	**	6.7880
+	Education	Transfer	0.0693	**	3.1930	0.0634	**	2.9920	0.0622	**	2.9350
+	Foreign Language	Transfer	0.0162		0.5000	0.0119		0.3780	0.0105		0.3330
+	Life sciences	Transfer	-0.0454		-1.4530	-0.0515		-1.6860	-0.0498		-1.6320
+	Mathematics	Transfer	0.1830	**	6.1630	0.1766	**	6.0500	0.1770	**	6.0670
+	Other	Transfer	0.0626		1.6370	0.0537		1.4300	0.0545		1.4500
+	Physcial Sciences	Transfer	0.0835	**	3.0010	0.0678	**	2.4940	0.0702	**	2.5910
+	Protective Services	Transfer	0.0289		0.7080	0.0263		0.6540	0.0289		0.7200
+	Social Sciences	Transfer	0.0860	**	3.4220	0.0780	**	3.1740	0.0805	**	3.2800
+	Architecture	Transfer	0.1090	*	2.1360	0.1019	*	2.0460	0.1039	*	2.0870
+	Computers	Specific	0.2980	**	12.5440	0.2908	**	12.5480	0.2936	**	12.7220
+	Engineering	Specific	0.3760	**	15.5870	0.3657	**	15.4380	0.3700	**	15.8010
+	Health	Specific	0.2830	**	13.1580	0.2760	**	13.1490	0.2733	**	13.0510
Education and Experience Variables											
+	GPA As		-0.0523		-0.6520						
+	GPA As & Bs		-0.0584		-0.7320						
+	GPA Bs		-0.0876		-1.0970						
+	GPA Bs & Cs		-0.1110		-1.3810						
+	GPA Cs		-0.0966		-1.1690						
+	Work Experience		0.0262	**	17.0180	0.0256	**	17.0610	0.0257	**	17.1500
+/-	Work Experience^2		-0.0005	**	-6.6130	-0.0004	**	-6.2880	-0.0004	**	-6.3340
Demographic Controls											
-	Female		-0.0145		-1.6080	-0.0117		-1.3300			
-	Black		-0.0198		-1.1720	-0.0391	**	-2.4650	-0.0395	**	-2.4940
-	Other		0.0408	**	2.9220	0.0387	**	2.8970	0.0381	**	2.8860
+/-	Married		0.0762	**	5.5260	0.0740	**	5.4320	0.0787	**	6.0520
+/-	Child		0.0479	**	2.8550	0.0561	**	3.3950	0.0574	**	3.4800
-	[Female x Married]		-0.0467	**	-2.7810	-0.0379	*	-2.2810	-0.0458	**	-2.9980
-	[Female x Child]		-0.0471	*	-2.3470	-0.0587	**	-2.9760	-0.0611	**	-3.1120
+/-	Northcentral		-0.0836	**	-9.4570	-0.0859	**	-9.8670	-0.0834	**	-10.6130

-	South	-0.0931	**	-10.6690	-0.0993	**	-11.5990	-0.0966	**	-12.6220
+/-	West	-0.0060		-0.6000	-0.0075		-0.7550			
+/-	Father High School	0.0023		0.2150						
+/-	Father Some College	0.0035		0.3710						
+/-	Father College	0.0161		1.6730						
+/-	Mother High School	-0.1369		-1.1780						
+/-	Mother Some College	-0.0024		-0.1940						
+/-	Mother College	-0.0087		-0.6650						
Labor Market Controls										
-	Government Employee	0.0256	**	3.2380	0.0251	**	3.2210	0.0238	**	3.0790
+/-	Self-employed	0.0378		1.5080	0.0399		1.6050			
-	Non-related job	-0.2260	**	-24.7170	0.2311	**	-25.7910	-0.2306	**	-25.7640
Summary Statistics										
	R	0.4930			0.4890			0.4880		
	R^2	0.2430			0.2390			0.2380		
	Adjusted R^2	0.2400			0.2370			0.2370		
	F Statistic	91.530	**		121.313	**		132.245	**	
	Sample Size	13477			13958			13972		

* Indicates significance at the .05 level

** Indicates significance at th e .01 level

is necessary to examine the relationship between the different groups of majors, general, transferable, and specific, rather than concentrate on the relationships between individual majors within any of these groups. The relationship between these individual majors is important for decision-making purposes for individuals choosing a college major but is less vital in testing the above-mentioned hypothesis.

Majors classified as being in the general category were expected to have a mixture of positive and negative signs and small positive coefficients since the omitted variable psychology is part of the general category. The results of the regressions support these predictions completely. None of the majors, with the exception of philosophy and religion, which has a large negative coefficint, have wages that are statistically different from psychology. All of the coefficients are small despite their insignificance further indicating they are at the bottom end of the wage spectrum.

Majors classified as being in the transferable category were expected to have all positive signs and coefficients that are larger than those in the general category. Life sciences and agriculture failed to meet these criteria, however.

The life science major was not statistically significant and did have a negative sign. The reason for this result is unclear since life science does provide some specialized skills such as lab techniques that are not found in more general majors. It is also possible that since a large number of life science students pursue advanced degrees, the skills acquired through an undergraduate life science major are not that applicable to the job market. The negative sign and statistical significance of the agriculture major may have resulted from low prices in the commodities markets in the year of the survey or the overall decline in the agricultural sector. Since many agriculture majors enter farming and ranching professions where income is highly dependent on unpredictable factors such as the weather, the wages of these individuals may be more volatile year-to-year than those of other majors. Further research using different time periods would be necessary to examine this problem more extensively. Overall, however, the transferable majors seem to have higher wages than

those in the general category. Of the eight positive coefficients in this category, five of these majors are statistically greater than psychology at the .01 level. Comparing the positive coefficients in the general category to those in the transferable category also clearly indicates that the size of the coefficients is much greater on the whole for majors that offer transferable skills. The hypothesis that majors that offer transferable skills earn more than majors that offer general skills is hereby supported.

The four majors in the specific category were expected to have positive signs and coefficients that were greater than those of the transferable category. The regression results support these predictions with all majors having positive signs and being statistically significant. Furthermore, engineering, computers, and health had the three largest coefficients in the study all of which were substantially larger than the major with the fourth largest coefficient, mathematics. Though the coefficient for architecture is smaller than that of business and mathematics, the results as a group strongly support the hypothesis of this paper. The lower wages for architecture majors is likely tied to the fact that this study is examining starting salaries and architecture majors frequently participate in some sort of apprenticeship following graduation.

The majors that create the more specific skill sets have thus been empirically shown to lead to higher wages than those with more general skill sets. These results are consistent with the wage differentials found in the economic literature. In a 2003 article, Black, Sanders, and Taylor found that engineering and computer science afforded the highest wages while those majoring in the arts, humanities, philosophy, and religion were paid the least. Finnie and Frennette (2003) who examined the effect of college major on wages for men and women separately found similar results. By examining three different cohorts, they discovered that for both men and women engineering and health majors earned the most while those majoring in the arts and humanities earned the least (Finnie and Frennette, 2003). Even when examining aggregated major groups, Scholz (1995) concluded that engineering, business, and science majors earned significantly more than their liberal arts counterparts.

Though my categorization of individual majors was based on common knowledge and may not be entirely accurate, the overall conclusions of the study remain. Computers, engineering, health, mathematics, physical science, and architecture majors all fair much better than their schoolmates in communications, liberal arts, psychology, philosophy, and the arts. In examining the aforementioned results and the previous economic research, few would argue that the better paying majors do not also provide more specific skills.

B. Control Variables

Educational, work experience, demographic, and labor market control variables were used in this study in an attempt to provide a *ceteris paribus* comparison of the effect of majoring in a particular field of study. The predicted signs of these coefficients can be seen in Table 3. A number of the control variables in the initial regression proved to be highly insignificant and thus were eliminated in later regressions. The effect of removing these variables can be seen in Models B and C of Table 3. Their removal had very little impact on the regression as a whole or on the size, sign, or significance of the college major variables indicating that the model is quite robust.

Contrary to expectation, the grade point average dummy variables were highly insignificant in the model and had negative signs. This indicates that at least initially, grades have little impact on salary contrary to the results found by Fuller and Schoenberger (1991). GPA may in fact not be a good proxy for mental ability or other factors and therefore is not rewarded in the workplace. The insignificance of the female dummy variable also seems to initially contradict some of the research on the gender wage gap (Daymont and Andrisani, 1984; Fuller and Schoenberger, 1991; Gerhart, 1990). The interactions between gender and marriage and gender and children, however, are significant and negative indicating that though being a woman does not negatively affect wages being a married woman or one with a child does. This is consistent with the arguments that being a female and being married or having a child may lead to time outside the labor force or increased absenteeism as previously discussed in the empirical section. The variables for parental education were also highly insignificant and thus were removed in subsequent regressions. These variables may not effectively proxy the socio-economic background of the individuals, or the impact of early life economic factors may have little impact once an individual has completed a degree and obtained a job. However as

expected, having a job that is not at all related to one's major has a severe negative effect on wages. Since some majors may be more likely than others not to find work related to their major, controlling for this variable helps to solidify the differences that exist among college majors based on skill levels.

VI. CONCLUSIONS AND POLICY IMPLICATIONS

The choice of college major is all too often a long and difficult one for students. The impact of this single decision on the remainder of their working lives makes the assessment daunting in the eyes of many. The consideration of future earnings unquestionably arises in the minds of nearly all of these undecided scholars because as this paper has shown yet again, the choice of major has a profound impact on the future income of graduates.

To this point, the research on the effect of college major on wages has been largely limited to the explanation of the gender wage gap and empirical examinations of wage differentials based on college major (Angle and Wissman, 1981; Black, Sanders, and Taylor, 2003; Daymont and Andrisani, 1984). The purpose of this paper was to provide a theoretical basis of the impact of college major on wages, which has been largely lacking in the literature and to test that theoretical model empirically.

As demonstrated by this study, majors that provide more specialized or technical skills lead to higher wages because they make the individual more productive on the job. Individuals wishing to maximize their monetary income, therefore, can choose those majors that are the most specific and technical and in most cases be assured a higher working wage. In the long-run, however, there is an opportunity cost associated with college major choice that must be considered. Those majors that are the most specific also come with the highest opportunity cost because the ability to change career paths is more restricted. Thus in essence, students have the ability to choose between wages or mobility when picking a college major. For those who wish to maximize their bottom-line, majors in areas such as engineering, computer science, and health ensure significant wage premiums. But for individuals, who want a larger diversity of opportunities and the ability to change jobs or career paths quickly, locking into a specialized major may not be the wisest decision even though it leads to the greatest monetary reward.

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